

What is claimed is:

1. A fuel cell device comprising:: an electrolyte sheet, said electrolyte sheet including a substantially non-porous body of a varied thickness, said electrolyte sheet having one side with a relatively smooth surface and another side with a more textured surface with multiple indentations therein, wherein the thickest part of said electrolyte sheet is at least 0.5 micrometers greater than the thinnest part of said electrolyte sheet;

one side of said electrolyte sheet experiencing a predominately compressive force, the other side of said electrolyte sheet experiencing a predominately tensile force, wherein the side with a relatively smooth surface is subjected to the predominately tensile force and more textured surface subjected to predominately compressive force.

2. A fuel cell device comprising:: an electrolyte sheet, said electrolyte sheet including a substantially non-porous body of a varied thickness, said electrolyte sheet having one side with a relatively smooth surface and another side with a more textured surface with multiple indentations therein, the thickest part of said electrolyte sheet being at least 0.5 micrometers greater than the thinnest part of said electrolyte sheet; and

wherein said relatively smooth side is the fuel facing side and said more textured side is the air-facing side.

3. The fuel cell device of claim 2, wherein said electrolyte sheet includes thicker and thinner areas and the thinner areas become progressively thinner closer to the edges.

4. The fuel cell device of claim 2, wherein said electrolyte sheet is subjected to higher stress in some regions and to lower stress in other regions, said regions experiencing higher stress having an average thickness that are greater than the average thickness being of the regions experiencing lesser stress.

5. The fuel cell device of claim 2, wherein said electrolyte sheet is subjected to higher relative pressure in some regions and to lower relative pressure in other regions, said regions

experiencing higher pressure having an average thickness that is greater than the average thickness of the regions experiencing low pressure.

6. The fuel cell device of claim 2, wherein the thickest part of said electrolyte sheet is at least 2 micrometers greater than the thinnest part of said electrolyte sheet.
7. The fuel cell device of claim 2, wherein said electrolyte sheet has an average thickness greater than 5 micrometers and less than 100 micrometers.
8. The fuel cell device of claim 2, wherein said average thickness is below 45 micrometers.
9. The fuel cell device of claim 2, wherein said electrolyte sheet has an average electrolyte sheet thickness between 3 micrometers and 30 micrometers;
said fuel cell device further includes: at least one cathode disposed on the more textured side of said electrolyte sheet;
at least one anode disposed opposite the cathode on the relatively smooth side of said electrolyte sheet.
10. The fuel cell device according to claim 1, wherein the electrolyte sheet is a ceramic sheet formed of a polycrystalline ceramic selected from a group consisting of partially stabilized zirconia or stabilized zirconia, and being doped with a dopant selected from the group consisting of the oxides of Y, Ce, Ca, Mg, Sc, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, In, Ti, Sn, Nb, Ta, Mo, W and mixtures thereof.
11. The fuel cell device according to claim 10, wherein said average electrolyte sheet thickness is between 4 and 15 micrometers.
12. The fuel cell device according to claim 11, wherein said electrolyte sheet is flexible.

13. A method of making an electrolyte sheet, said method comprising the steps of:
- (a) providing a green slip on a carrier, said slip containing a relatively volatile material to form a green sheet having an average thickness of less than 100 microns;
 - (b) at least partially evaporating said volatile material;
 - (c) embossing said green sheet with at least 0.5 micrometer variations in its thickness thereby providing textured green sheet ;
 - (d) sintering the textured green sheet to provide an electrolyte sheet with substantially non-porous body, the non porous body having a textured surface with multiple indentations therein, wherein the thickest part of the electrolyte sheet is at least 0.5 micrometers greater than the thinnest part of the electrolyte sheet and the electrolyte sheet has an average thickness of less than 100 microns .
14. The method of claim 13, wherein said embossing step is performed while said green sheet contains at least 10 to 50% of said volatile material.
15. The method of claim 13, wherein said step texturing said green sheet includes texturing said green sheet with at least one textured roller while heating said green sheet to a temperature of at least 30°C.
16. The method of claim 13, wherein said green sheet is squeezed between two rollers, wherein at least one of said rollers is a patterned roller.
17. The method of claim 13, wherein said method includes the step of providing (i) a carrier roller; and (ii) another roller, and wherein a carrier is supporting the green sheet is situated between said carrier roller and said another roller.
18. The method of claim 17 wherein said other roller is the green sheet take up roller.
19. The method of claim 17 wherein said other roller is the carrier sheet take up roller.

20. The method of claim 17, wherein said step of texturing said green sheet includes texturing said green sheet with at least one textured roller.
21. The method of claim 13, wherein said textured green sheet is bent between two rollers, thereby providing corrugated textured green sheet.
22. A method of making an electrolyte sheet, said method comprising the steps of:
 - (a) providing a green slip on a patterned carrier with at least 0.5 micrometer surface variations, said slip containing a relatively volatile material;
 - (a) spreading said slip on said patterned carrier to form a textured green sheet having at least one textured surface and an average thickness of less than 100 microns;
 - (b) at least partially evaporating said material;
 - (c) sintering the textured green sheet to provide an electrolyte sheet with substantially non-porous body, the non porous body having a textured surface with multiple indentations therein, wherein the thickest part of the electrolyte sheet is at least 0.5 micrometers greater than the thinnest part of the electrolyte sheet and the average thickness of said electrolyte sheet is less than 100 microns.
23. The method of claim 22, further comprising contacting said textured green sheet with a patterned roller so as to produce a green sheet that has two textured surfaces.
24. The method of claim 23, further including the step of heating said roller.
25. The method of claim 22, further including the step of feeding said textured green sheet is between two rollers, thereby providing corrugated textured green sheet.
26. The method of claim 25, further including the step of heating said two rollers.

27. The method of claim 22, further including the step of forming said patterned carrier is by embossing.

28. The method of claim 22, wherein said method includes the step of providing: (i) a carrier roller; and (ii) another roller, and wherein a carrier is supporting the green sheet is situated between said carrier roller and said another roller.